that which now prevails. We will not return for a long time to the low interest rates of twenty years ago, but it seems entirely likely that we will work well down to the level of 1913. Liberty bonds, unless some unforeseen event arises, should be at par within three years, and all high-grade investment securities of long maturities should rise accordingly.

It is always difficult to forecast for any considerable period in the future the resultant of such complex forces as those which underlie the rate of interest. But the fundamental factors which operate upon the demand for capital and those which determine its supply after a period of business depression are such as will inevitably reduce the rate of interest.

Industrial Waste

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IN January, 1921, Herbert Hoover, as president of the Federated American Engineering Societies, named seventeen engineers to make a study of waste in industry. The federation of engineering societies was new; Mr. Hoover was its first president. At the organizing meeting held in Washington in November, 1920, Mr. Hoover proposed the study and was authorized to make the investigation.

There was peculiar fitness in the subject thus undertaken by the Federated American Engineering Societies, inasmuch as the object of the organization is to further public welfare whenever technical knowledge and engineering experience are involved, and to consider and act upon matters of common concern to the engineering and allied technical professions. The "assay of waste" undertaken by the Committee on Elimination of Waste in Industry was, as Mr. Hoover outlined it, to be a three months' investigation of a series of "samples" from which might be deduced general recommendations applicable to American industry as a whole.

The personnel of the committee consisted of eighteen carefully selected engineers. In selecting the members of the committee, care was taken to secure men of broad experience, clear concepts, and unbiased attitude towards industrial problems. Representatives of managerial, consultant, educational and editorial activities were chosen, with an eye also to their widely distributed and varied industrial contacts.

When the "assay" began, the committee itself selected with great care the engineers who conducted the field investigations. The engineering firm employed to investigate a given industry was chosen because it had a long and a favorable record in that particular type of industry. Thus was brought to bear upon the plans, findings and recommendations, the accumulated and composite knowledge and experience of some fifty or more engineers. In many phases of the work other specialists, such as economists, statisticians, employment managers and industrial physicians had an important part in collecting the material and in drawing up the conclusions. An earnest effort was made to obtain the advice and the accumulated information of every known agency or individual that could throw any light upon the subject in the time allowed.

The essence of the plan adopted by the committee was to gather quickly such concrete information as might be used to stimulate action and to lay the foundation for other studies. It was believed that a limited, yet carefully studied volume of findings obtained through a rapid intensive study, would not impair the value of the facts disclosed or the validity of the recommendations based upon them. So within less than five months the committee completed an "assay" or analysis of waste in six typical branches of industry, and presented a summary of its findings to the Executive Board of the American Engineering Council, which is the governing body of the Federated American Engineering Societies. This took place on June 3, 1921, in St. Louis, at which time a condensed news abstract was given to the press. The complete report is now being printed in book form.

The original plan contemplated ten investigations in the field, including transportation and coal mining. Six have been completed. These include the building trades, men's ready-made clothing, boots and shoes, printing, metal trades and textile manufacturing. In addition to these specific field studies, seven general reports of a statistical character were prepared, each of them dealing with some aspect of industrial waste or its elimination on an extensive or nation-wide basis.

The industries selected for specific study are of great public importance, for their operation directly affects the daily life of everyone. It is believed that the sources of waste in these industries may safely be taken as generally characteristic of the waste in American industries as a whole. It is thought that the findings are not exceptional, and certainly the industries selected were chosen in the belief that they are fairly representative.

RESPONSIBILITY AND OPPORTUNITY THE POINT OF VIEW

In making the studies upon which the report was based and in preparing the report itself, there was no purpose or desire to place blame upon any individual, group or class. It is believed that the wastes revealed are the inevitable result of methods, practices and relationships of long standing in industry, and the committee has relatively little interest in pointing out the various responsibilities for these. In contrast, it desires to indicate the main opportunities for eliminating waste and whose opportunity or responsibility it may be to adopt proper measures for such elimination.

No attempt has been made to write an academic definition of waste or to speculate in regard to ultimate savings. For the purpose of the report, no attempt has been made to consider all economic wastes. Rather, in the committee's investigations, industrial waste has been thought of as that part of the material, time and human effort expended in production represented by the difference between average attainments on the one hand and the practical attainable performance on the other, as revealed by the detailed reports. In assaying waste in industry the committee has undertaken to evaluate this difference. Thus it has established no theoretical standard of performance or excellence, but has developed a method of measurement to determine the degree of effective use of those factors within which it was believed waste might be discovered. It has conceived that a given practice is not wasteful until a better has been revealed.

PLAN OF STUDY—QUESTIONNAIRE AND EVALUATION SHEET

The plan of study followed in each of these six branches of industry in-

vestigated was this: at the outset the members of the committee prepared an analysis of those factors and operations in industry in which waste might be expected to be discovered, provided a comparison was made between average practice and the best known practice. From this analysis, a trial questionnaire was prepared to secure information and quantitative data to permit of comparing the record of one plant with another in the same industry. The questionnaire is composed of 58 main topics and 260 leading questions. This indicates the multiplicity of avenues through which waste may occur.

This trial questionnaire was then used in making a study of one plant in each industry. The results of these trial studies were then brought together, compared, reviewed by the committee and, as a result, a revised questionnaire and an evaluation sheet were prepared, to be used in making the studies upon which the report is based. The revised questionnaire, as used with suggested modifications based on the experience accumulated in its use in the field studies, forms an important part of the report.

CALENDAR OF THE STUDY

The committee was named on January 12; its working program was approved on February 7; the first detailed report was in on April 1, and the last on May 13.

OUTSTANDING FEATURES OF THE REPORT

Some of the outstanding features developed are:

First: There is apparent a lack of a common terminology of management and personnel factors. This lack is the cause of much confusion. To one group the word management means one thing; to another an entirely different meaning is conveyed. The public is confused by a lack of common knowledge of the meaning of industrial and management terms. Take "Collective Bargaining" and "Closed and Open Shop" for examples. We venture to say that if the people were to be asked for a definition or an interpretation, nothing approximating uniformity would be obtained in reply. There is a great need for constructive work in defining such terms. The establishment of a common terminology and a concrete definition of industrial words and phrases would lead to the elimination of much misunderstanding throughout industry.

Second: Another very significant need is the creation of standard units of measurements for the various factors of management. This applies particularly to the factors of individual and group performance. It is true that there are some factors of management for which it would be exceedingly difficult if not almost impossible to create and to apply units of measurement, yet there are many for which it can be done. It is also true that some progress has been made in the way of establishing standards for gauging individual and group performance. But in the main the practice is limited and based upon inadequate data and faulty premises. It has not been approached in as thorough and scientific a manner as its importance would justify. In a very large degree the whole system of wage payment is faulty because it is not based upon facts scientifically arrived at; and further, in a great degree definite standards of performance are not known.

Third: In the realm of industry there is no agency that can furnish complete, timely and authoritative information concerning any one or all of the important factors of production. Until basic, timely and authoritative data are known, no rational remedy can

be evolved for solving any industrial, economic, social or political problem. On so vital a thing as unemployment there is no central bureau of information; the facts have to be pieced together, so to speak. Last January and February some three to four million workers were out of employment, but no one knows just how many and no one knows what classes of trades were represented and in what proportion. The causes contributing to such conditions and the remedies to apply are still undefined. As such conditions arise from time to time, unemployment committees, boards and commissions are appointed which study the problem, collect data, make recommendations, apply some temporary measures of relief, and disappear. The emergency passes. The information collected, the experience gained and the effectiveness of measures used are not adequately recorded; consequently, when a similar emergency re-occurs it is again approached as a new and an unsolved problem. Information is needed not only to meet emergencies but to meet what appears to be a "normal" unemployment of a million of those classed as gainfully employed. What are the economic, industrial, political, social or mental conditions which cause one out of every forty of those that are supposed to be gainfully employed to be constantly out of employment? No one knows; no one can definitely state what really is the situation and what to do if the apparent facts are as represented.

Again, there is a large seasonal unemployment or intermittent employment, which adds many hundreds of thousands to the normal or constant unemployment. The clothing worker is idle approximately 31 per cent of the year; the shoe-maker, 30 per cent; the building trade worker, 37 per cent and others in like proportion. This being the case, there is a need for a permanent clearing house for unemployment and intermittent employment. It should be the function of such a bureau to make an exhaustive analysis of the many factors connected with unemployment so that such information and accumulated experience may at all times be available. Further, it should study the causes, analyze the remedies applied, make recommendations as to how to alleviate in emergencies, and, finally, suggest what might be done to bring about a more permanent or stable employment cycle. The advantages to accrue are large in social, political, industrial and economic values. For after all, much of the unrest, suspicion and disturbance among workers results from the sub-conscious and conscious fear of unemployment. This is made apparent by the fact that the so-called seasonal industries, as clothing and building, have had the greatest amount of labor disturbance. In 1919, 32 per cent of all strikes in New York were in the clothing and building industries.

In the matter of strikes and lockouts there is no central source of authoritative information. It is the belief of many that there should be central bureaus of information concerning many phases of industry, as the quantity of raw and finished materials, the cost of basic raw materials and the like. Until such bureaus are established, industry as a whole will continue to be wasteful, because without a knowledge of the facts, rational measures of correction cannot be evolved.

Fourth: There is a real need for some form of coöperation that will safeguard the interests of the public, yet permit of a free exchange of information between the various organizations of a given industry and between interdependent industries. Many plants of a given industry have developed and per-

fected important and economical management policies and practises which are not known to the industry in general. If they were known in detail by the industry as such, better conditions would prevail. It is also true that there is a great deal of duplication in the expenditure of money for research and other purposes, because of the lack of an interchange of information. Of course, it is recognized that a certain amount of such duplication is inevitable for purely commercial reasons, yet there is here a large area of mutual interest.

At the present time there is very little coöperation, coördination and exchange of information between interdependent industries. The manufacturer of clothing uses the material produced by the textile manufacturer. Likewise, the users of paper take the product of the paper maker. Very naturally there is a close community of interest between the designer and the retailer of ready-made clothing. Yet these two important elements of the clothing industry have not until recently taken any steps towards coöperation and coördination with reference to styles.

Fifth: It appears, from the available data, that the amount of waste from the general run of strikes, through the loss of wages and curtailment of production, is less than commonly thought. This of course does not refer to the losses that occur through such strikes as are all inclusive, such as real or threatened strikes on the railroads or in the steel industry.

That the apparent losses are less than commonly thought is in part due to the fact that the general run of strikes occur in seasonal industries. Thus, the total production for a given season may be and is often realized by prolonging the period of activity. For instance, more coal was mined in 1910 than in 1911, although the former year witnessed many protracted strikes involving large numbers of employees. In 1912, with 47 per cent of the entire labor force out on strike, and with an average loss per man of forty days, the output of coal per man, per day and per year, was more than 1911. There was also six days more employment than in 1911, a year which was relatively strikeless. The total production was also more.

In addition to the direct losses through wages and curtailed production there are, of course, indirect losses, but no means is available to determine the extent of such losses. The information obtainable is inadequate on any phase of the problem. There is no agency that has the responsibility and authority to collect the information requisite for a complete and authoritative analysis. There are complete statistics for the period from 1881 to 1905. But since 1906 the Department of Labor has had no authority to "require information relative to strikes from anyone."

Sixth: It is a fair statement that for the country as a whole there are no adequate functioning bodies for the adjustment of industrial disputes, and hence the checking of industrial waste that results therefrom. There are almost as many varieties of legal machinery for adjusting labor disputes as there are states. Seven states have laws for local arbitration, but no permanent agency to execute them. Two states legalize permanent district or county boards established by private parties. Nine states provide for arbitration or conciliation by the State Commissioner of Labor or some other state officials. In twenty-seven states there are laws creating a special State Board or Commission for the settlement of labor disputes. In Kansas, a Court of Industrial Relations has been established with very broad powers. Nine states

make provision for local boards as well as for bodies with state-wide powers.

A recent examination shows that all this machinery for the adjustment of industrial disputes is active in eleven states, that is, functions with more or less success; that it is inactive in five states, and dormant in nineteen. That there is a real need for some adequate agency to function in the realm of labor disputes is apparent.

Seventh: A lack of rational standardization of methods, practices, policies and designs is a prominent cause for industrial waste. A great advance and refinement can be made towards standardization without in any way limiting individual ingenuity or unnecessarily curtailing the reasonable desires of any person. The possibilities for standardization occur in almost every phase of industry.

Some of the outstanding facts regarding the losses resulting from a lack of standardization are made apparent by the following: The equivalent of 8,000,000 passengers are transported daily by the elevators of the city of New York. More passengers are thus handled than by all the street railway transportation methods used in that city. Notwithstanding its great importance, the architect, the engineer, the contractor, do not design or build the structure around the transportation medium, which is an important factor, but the transportation medium is placed wherever convenient; and it has often happened that the building has been well under way before the elevator was even thought of. Consequently, some of the structure had to be removed in order to make a place for it. The net result of all this lack of systematic planning or standardization has been that most elevators are built to fit the space that happens to be convenient. The economic loss through designing, constructing, installing and operating elevators under such a system is very large.

A very prominent locomotive building company was able to build 163 standard designed locomotives in five weeks, while it was able to produce only 104 locomotives of industrial design in the same period. Losses in production due to lack of standardization arise in every industry. You desire to build a home, an office or a factory building. You ask for designs and bids; six, eight or ten contractors submit plans, specifications, and bills of material. The contract is let to the lowest bidder; but in his price is included not only the cost to him of making the plans and specifications for your job, but also a percentage to cover the cost of all other jobs on which he has placed a bid and has not secured the order, or else a percentage to cover the cost of the other seven or eight bidders, there sometimes being an agreement among the bidders that this be done. In certain cities there are some bidders who always bid high. They do not want the contract. They make their living by the commissions collected on their useless figures.

The examples cited serve to indicate that waste occurs because of change of style or standards, no planning, inadequate standards, faulty and uneconomic designs.

Eighth: The 42,000,000 men and women gainfully employed in the United States probably lose 350,000,000 days annually from illness disabilities, including non-industrial accidents. Tuberculosis is the most important disease among industrial workers. Pneumonia, influenza, typhoid fever, hook-worm and malaria are prominent causes of industrial waste through the temporary or permanent loss of earning powers of millions of workers. There are more than 6,000,000 workers with organic diseases resulting mostly

from infection. More than 25,000,000 workers have defective vision requiring correction.

These figures clearly indicate the great economic waste that comes about through subnormal standards of health and vigor.

Ninth: Industrial accidents contribute a large amount annually to industrial waste. In 1919 there occurred in industry about 23,000 fatal accidents and about 575,000 non-fatal accidents causing four weeks or more of disability; a total of 3,000,000 accidents causing at least one day's disability. The figures for 1918 were about thirteen per cent higher. In the building industry, enormous losses occur through accidents, the $20,000,000 paid yearly to insurance companies for compensation being only a part of the total cost, even if we disregard all human and spiritual values. The best authorities say that the actual cost of insurance represents not more than twenty-five per cent of the total economic loss which brings the total cost to the industry due to accidents in the vicinity of $120,000,000. Experience has shown that by the adoption of proper measures the waste due to accidents may be reduced from seventy-five to eighty per cent in from two to five years of earnest effort.

* * *

From the foregoing discussion, based upon a careful report it is shown that the industrial waste in the United States is enormous. That much of it can be eliminated is obvious, which conclusion is also supported by the evidence. In every industry studied, outstanding plants were found wherein much of the waste occurring in other plants had been eliminated.

No individual or agency wholly escapes responsibility for waste. The owner, the management, the workers, the public have a definite responsibility and at the same time an opportunity. The degree of responsibility is not fixed nor is there a definite ratio of responsibility for each group. This will vary with different industries. It may not be the same for two plants in the same industry. The evaluation of responsibility for remedying the condition as derived by the Committee places more than fifty per cent upon management and less than twenty-five per cent upon labor. That is to say, if industrial waste is to be eliminated management can through its opportunity remove more than fifty per cent of it, whereas labor can through its opportunity remove less than twenty-five per cent.

If American industry is to flourish, if it is to pass successfully through this trying period, if it is to withstand the foreign competition that is sure to come in the immediate future and at the same time to pay such compensation to all connected with industry as not to lower standards of living and to retard a natural and desirable increase of those standards, those responsible for waste in industry will have to adopt methods and policies, which by practical demonstrations have proven to be efficacious.